Universitat de Lleida

DEGREE CURRICULUM

# ANIMAL BIOTECHNOLOGY

Coordination: PENA SUBIRÀ, RAMONA NATACHA

Academic year 2020-21

# ANIMAL BIOTECHNOLOGY 2020-21

## Subject's general information

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|---|---|
| **Subject name** | ANIMAL BIOTECHNOLOGY |
| **Code** | 100336 |
| **Semester** | 1st Q(SEMESTER) CONTINUED EVALUATION |
| **Typology** | |

| Degree | Course | Character | Modality |
|---|---|---|---|
| Double bachelor's degree: Bachelor's Degree in Veterinary Medicine and Bachelor's Degree in Science and Production | 5 | OPTIONAL | Attendance-based |

| | |
|---|---|
| **Course number of credits (ECTS)** | 6 |
| **Type of activity, credits, and groups** | |

| Activity type | PRALAB | PRAULA | TEORIA |
|---|---|---|---|
| Number of credits | 1.2 | 1.8 | 3 |
| Number of groups | 4 | 1 | 1 |

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| **Coordination** | PENA SUBIRÀ, RAMONA NATACHA |
| **Department** | ANIMAL HUSBANDRY |
| **Teaching load distribution between lectures and independent student work** | On-site or tutor-guided hours: 60h<br>Off-site (self-paced) hours: 90h |
| **Important information on data processing** | Consult this link for more information. |
| **Language** | English |

# ANIMAL BIOTECHNOLOGY 2020-21

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|---|---|---|---|
| PENA SUBIRÀ, RAMONA NATACHA | romi.pena@udl.cat | 11,52 | |

## Subject's extra information

**Requirements**

Although there are no official prerequisites, it is advisable that students know fundamental concepts of genetics and are able to read scientific texts in English.

## Learning objectives

**Learning objectives: Students who pass the course must :**

- CE36.1.01 Distinguish the molecular techniques used in genome analysis (mapping, genotyping of polymorphisms and functional genomics studies) and the proteome.
- CE36.1.02 Recognize patterns of inheritance and the genetic basis of Mendelian and complex characters.
- CE36.1.03 Describe the major types of genetic variation and their application in the context of conservation, breeding and disease control.
- CE36.1.04 Evaluate their effect on the characters mutations productive domestic species.
- CE36.1.05 Interpret the applications of biotechnology in the context of animal production.
- CE36.1.06 Apply different crossbreeding systems as a tool for genetic improvement.
- CE36.1.07 Describe the most common methods for generating transgenic animal production.
- CE36.1.08 Know some applications of transgenesis in animal production and biomedicine.

**Capacity objectives: Students who pass the course should be able to:**

- CE36.1.09 Understand the genetic basis of complex traits related to animal production.
- CE36.1.10 Integrate genetic markers in animal breeding schemes.
- CE36.1.11 Describe the strategies to discover novel of genetic markers and biomarkers.
- CE36.1.12 Explain the current status of livestock transgenic animal.
- CE36.1.13 Give personal opinion on the application of transgenesis in production and biomedicine.
- CE36.1.14 Communicate orally and in writing in English.
- CE36.1.15 Present / communicate clearly and in an organised manner both orally and in writing .

## Competences

**COMPETENCE FRAMEWORK**

Apply the advances in biotechnology to livestock species in order to assess their usefulness and interest in the practice of animal health and production and in the biomedical environment.

**GCPA core competences**

- CB1. To possess and understand knowledge in an area of study that starts at the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of your field of study
- CB2. To apply their knowledge to their job or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of

problems within their area of study
- CB3. Ability to collect and interpret relevant data (usually within their study area) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature
- CB4. Being able to transmit information, ideas, problems and solutions to a specialized and non-specialized audience)
- CB5. To know how to develop those learning skills necessary to undertake further studies with a high degree of autonomy
- CB9. To use the basic working methodologies referring to the disciplines indicated
- CB10. To recognize and know how to apply the basic techniques of livestock experimentation and know how to interpret its results

**GCPA transversal competences**

- CT1. To acquire adequate oral and written comprehension and expression of Catalan and Spanish
- CT2. To acquire significant command of a foreign language, especially English
- CT3. To acquire training in the use of new technologies and information and communication technologies
- CT4. To acquire basic knowledge of entrepreneurship and professional environments
- CT5. To acquire essential notions of scientific thought
- CT6. To analyze concrete situations, define problems, make decisions and implement action plans in search of solutions.
- CT7. To apply acquired knowledge to real situations, appropriately managing available resources.
- CT8. To interpret studies, reports, data and analyze them numerically.
- CT9 Select and manage the written and computerized information sources available related to the professional activity.
- CT11 Manage individual and team work
- CT12 Acquire comprehensive training.
- CT14 Know and apply the scientific method in professional practice

## Subject contents

**SECTION 1 - Biotechnology tools and the genetic modification of populations**

**Topic 1. Overview of animal biotechnology -** The concept of biotechnology. Main areas of application of biotechnology in animal production and animal health and in the biomedical field. (1h)

**Topic 2. The DNA markers as a fundamental tool of animal biotechnology -** molecular markers (SNPs, microsatellites, CNVs). Applications of markers in veterinary sciences. (1h)

**Topic 3. Basic techniques of molecular genetics I -** Isolation of genomic DNA and RNA. Electrophoresis. Restriction enzymes. (4h)

**Topic 4. Basic techniques of molecular genetics II -** PCR, RT-PCR and qPCR. Sequencing (Sanger, new technologies). (4h)

**Topic 5. Genomic tools in livestock species -** Methods for SNP genotyping in animal production (PCR-RFLP analysis, allelic discrimination, primer extension). Novel biotechnology tools: SNP-chips, deep sequencing. Examples in the market. (2h)

**SECTION 2 - Applications in animal production and health and in the biomedical field**

**Topic 6. Manipulation of gene expression in transgenic animals -** Obtaining transgenic animals: basic concepts and general strategies. Methods: **(i)** pronuclear microinjection of DNA into fertilized oocytes, **(ii)** viral vectors **(iii)** mediated gene transfer stem cells (ES cells), **(iv)** nuclear transfer, **(v)** transgenesis mediated by the sperm. Advantages and problems of each method. Study of transgene integration and expression: analysis of the lines and founders of settlements stable. The CRISPR-Cas methodology and other genome-editing approaches. (3h)

**Topic 7. Transgenic animals in animal production and health -** Genetically modified livestock animals. Novel traits of added value in livestock. Modification of the composition of milk and other productive traits. Transgenesis and genetic resistance to disease. Implemmentation of gene-modified animals in commercial systems. (3h)

**Topic 8. Animal Pharming.** The transgenic livestock as bioreactors. Production of recombinant proteins in milk, eggs and other products. (2h)

**Topic 9. Transgenic animals in applied research -** Animal models of human disease: hereditary diseases (monogenic and multifactorial).Xenotransplantation, key aspects. Biosafety and risks of animal transgenesis.(2h)

**Topic 10. Legislation** - Current state of the application of transgenesis in Europe and in the rest of the world. New opportunities. (2h)

**Practical activities**

**Practical 1** (2h): **BYO computer** - Primer design omtimised to different strategies and applications- Sequence manipulation, comparison and alignment tools available on line.

**Practical 2** (6h): **Laboratory** - Detection of fraud in the food chain: the origin of milk / meat products

**Practical 3** (6h): **Laboratory** - Cloning and characterization of DNA into plasmid vectors.

**Project** (12h): **Design of a diagnostic protocol for animal production:** development of a commercial brochure with technical and economic information.

**Seminar 1** (2h): What you always wanted to know about **the genome**. **Epigenetics**.

**Seminar 2** (2h): Personalised medicine. **Genetic test in pet animals**.

**Seminar 3** (2h): **The social implications of animal biotechnology –** Visualisation of a video about animal biotechnology; brief discussion on the content and views expressed in the documentary.

## Methodology

The course will be based on the **development of a PROJECT**. A number of project proposal releated to diagnosis of infectious or genetic disease, detection of frauds on animal products or the development of transgenic constructs, will be disussed during the first session of the course. Students are welcome to propose a new project topic acording to their personal interests. To develop this project we will set a number of CHALLENGES that will need to be reached on time. The aim of the Project is to promote the students' creativity by incorporating the most important aspects studied in this course in a practical context.

The course will be organised in lectures, practicals and project tutorials, which will be planed according to the needs of each challenge. Lectures, practicals and tutorials might intermingle in the same session.

1. Lectures. The lectures are based on sessions of theory and are intended to introduce the subject of each topic. Flipped classroom methodologies, where students will revise the contents before coming to the lessons, will be encouraged. To this aim, a number of complementary activites, which can be completed individually or in small groups, will be available in the Campus Virtual. Cooperative learning activities will be encouraged through interspersed short activities during the presentation of the topic. Support for the use of oral and written English will be provided in the form of specific hand-outs to backup both grammar and vocabulary and composition topics.

2. Practicals. The practicals consist of sessions on laboratory, computer lab, problem solving sessions and seminars. In this context we will practice audiovisual presentation of the results (slideshow, video) and how to deliver written reports. It is **MANDATORY** that students have the following personal protective equipment (PPE) in the course of face-to-face practices: Face masks (all practices) and lab coat (lab sessions only). Students failing to bring the required PPE or not complying with the general security rules will be denied access to the lab.

- The **lab practical** will bring into practice two of the project developed by the students. Students will be given the chance to participate in the set up of the practice, the preparation of the practice material and handbook, and the delivery of the practical session. For each practical, a report shall be delivered with tasks related to course contents.
- During the course, there will be three **seminars** that address issues of specific interest or relevance related to animal biotechnology.

1. Project tutoring. There will be general project tutorials with the whole class group as we move over the challenges. Individual and group tutoring sessions will be organised upon request, as we reach the final steps of the project.

Students will have the syllabus of the course in the subject of the e-portfolio, which includes all materials used in class, the complementary activities and specific notes for each topic  Each practical session will be complemented by a handbook with the objectives and procedures. All this material will be compiled in **TEACHING MODULES**, which will be available in the LESSONS tool of Campus Virtual.

**N.B. - During the 2020/21 year, the University of Lleida will implement a hybrid learning modality, which implies that there will be a combination of online and face-to-face activties. A Schedule of Activities can be found in the RESOURCES section of the course program and in the course CALENDAR in campus virtual, which indicates tje modality, day, time and place of each activity.**

## Development plan

All activities will be performed in groups of two except the development of the Project that would be performed in groups of 4-6 people. These groups will be established during the first session and will last for the rest of the course.

**Timetable**: The complete timetable with the **Schedule of  Activities** is currently uploaded in PDF format in the RESOURCES section and the course CALENDAR.

**Classroom**: ETSEA, - Building 3, first floor, Room 3.1.02

I indicate here the teaching facilities that will be used during the course:

- **Classroom** sessions. Room 3.1.02 or online (chech Schedule of Activities)
- **P01** – Practice 1. Room 3.1.02
- **P02** – Practice 2, Physiogenetics Lab. Building 1, 1st floor (1.1.04).
- **P03** – Practice 3. Physiogenetics Lab. Building 1, 1st floor (1.1.04).

***N.B. - Please, be aware of changes regarding schedules or classrooms that may come out during this semester to accommodate any changes in the health situation in our area. This notice also applies to changes in the face-to-face or online teaching of activities to respond to health emergencies that may arise during this semester.***

## Evaluation

There will be continuous assessment during the course, according to the following criteria:

1. Exam (35%).

   BLOCK 1 and BLOCK 2 will be assessed through a test consisting of **two parts:** the first part will consist of True/False questions of absolutely basic knowledge (two statements, one correct answer, an error subtracts 1 point) and a second part of short questions to develop where the ability to reflection, reasoning and analysis and the capacity for critical thinking will be assessed, The result of these tests will contribute to **15% (Bloc 1) and 20% (Block 2) of the final score.** See the Schedule of Activities for the exam date and time.

2. Reporting practices (20%).

   Filing a **report** with the resolution of the issues rose in the practical manual; summary and interpretation of results. The deadline for presenting the reports is indicated in the **Schedule of Activities** (Resources). Students must attend **ALL** sessions in order to be able to file the reports.

| Practical | Type | Weight of the report on the final grade of the course | Deadline presentation report |
|---|---|---|---|
| P02 | LAB | 10% | see **Schedule of Activities** in resources |
| P03 | LAB | 10% | |

3. Project (40%)

   This activity will be performed in **groups** of 4-6 students. The following activities will be assessed: individual contributions in tutorials, and the submission of a **written report (20%),** a **summary leaflet (10%)** and **oral presentation (10%)** in front of other classmates (see deadlines and presentation days in the **Schedule of Activities** in Resources**)**. Consultation of bibliographical sources, the ability to argue and to organize the oral and written presentation and the ability to defend the work publicly will be assessed. The individual work of each team member and their active participation in class activities will also be part of the assessment. A Rubric specific for each of this activities (report, leaflet, presentation) will be available in the Resources section of course.

4. Active involvement in class activities (5%)

   The individual involvement of each participant in the activities, debates and exercicies carries out in the classroom and in the labs will also be assessed.

| Type of activity | Weight (%) | Hours | ECTS | Learning outcomes | Criteria | Comments |
|---|---|---|---|---|---|---|
| Written test | 35% | 4 | 0.16 | 1-15 | One test | Theory; Seminars |
| Reporting practicals | 20% | 12 | 0.48 | 1,3,4,5,10,11,14 | Two reports | Laboratory |
| Project | 40% | 12 | 0.48 | 1,3,5,11,14,15 | Report<br>Leaflet<br>Oral Presentation | Theory; Problem-based learning; Tutorials |
| Participation | 5% | | | 11-15 | | Theory; Problem-based learning; Practicals |

**Comments**

If, following these criteria, a student does not reach the minimum grade of 5.0, he/she may sit a remedial exam within the specified academic semester. This examination will consist of a test of 20 True/False questions (30%, one correct answer, each mistake subtracts one point) and theoretical questions of short answer (50%).The final result will consider Practice reports submitted during the course (20%) when the mark of this additional exam is above 4.

# Bibliography

**Books available at the ETSEA library**


| | | |
|---|---|---|
| 1 | Aquaculture and fisheries biotechnology genetic approaches [Recurs electrònic] : Rex A. Dunham : | 2011 |
| 2 | Animals as biotechnology : ethics, sustainability and critical animal studies Richard Twine : | 2010 |
| 3 | Biotechnology in animal husbandry [Recurs electrònic] / edited by R. Renaville and A. Burny : | 2001 |
| 4 | Transgenic animal technology : a laboratory handbook edited by Carl A. Pinkert : | 2002 |
| 5 | Transgenic animals in agriculture edited by J.D. Murray... [et al.] : | 1999 |
| 6 | The GMO handbook : genetically modified animals, microbes, and plants in biotechnology Sarad R. Parekh, editor : | 2004 |
| 7 | Leonardo's choice genetic technologies and animals [Recurs electrònic] : edited by Carol Gigliotti | 2009 |
| 8 | Biotechnology applications in animal health and production co-ordinated by A.A MacKenzie | 2005 |
| 9 | Molecular biology of the gene James D. Watson ... [et al.] | 2013 |
| 10 | Molecular biology : principles and practice Michael M. Cox. Jennifer A. Doudna, Michael O'Donnell : | 2012 |
| 11 | Molecular biology and biotechnology edited by John M. Walker, Ralph Raply | 2009 |
| 12 | Molecular biology and biotechnology : a guide for students Helen Kreuzer & Adrianne Massey : | 2008 |
| 13 | **The Brief Penguin handbook / Lester Faigley** Llibre \| Pearson \| 2015 \| 5th ed. Exemplars a Bib. ETSEA (001.8 Fai) | 2015 |


**Online resources**

- http://www.genome.gov/10000464
- http://www.genome.gov/25019879
- http://www.rothamsted.ac.uk/notebook/engine.htm
- http://www.web-books.com/MoBio/Free/Chap9.htm

**Twitter accounts**

- @GeneticLiteracy
- @BioBeef
- @Naukas_com